

AD-A255 798



September 12, 1992

**Full Surface Testing of Grazing Incidence Mirrors**

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**Eighth and Final Quarter Report: Introductory Outline**

**FULL-SURFACE INTERFEROMETRIC SCANNER**

In the present report, we present the work done during the period of August 12 to September, 1992.

The work includes the implementation of the final testing program for the FSIS prototype system using the latest software package. It also included work on the final report.

The custom T.W.O. cylindrical mirror was used for testing. The scan is made of 5 subapertures, two inches each with one inch overlap area between subapertures.

The project goals for the eight quarters (entire contract) have been achieved. These include:

1. Prototype design,
2. Procurement and testing of components,
3. Mathematics and algorithm development,
4. Interferograms and data reduction algorithms,
5. Construction of first prototype,
6. Automated operation software development,
7. Construction and evaluation of modified prototype,
8. Integration of automated hardware controls and software,
9. Testing full surface interferometer/ aspheric optical surfaces,
10. Initiation of user manual and documentation,
11. Additional testing and modification,
12. Software refinement and development,
13. Completion of the users manual and documentation,
14. Report for the eighth and final quarter, and
15. Final project report.

DTIC  
ELECTED  
SEP 25 1992  
SBD

Research is supported by SDIO/IST and managed by ONR  
Contract # N00014-90-C-0246

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The measurement is now fully automated and operates as follows:

- The interferograms of the five subapertures are captured by scanning the mirror with the NEAT long travel stage under computer control
- Next, the interferograms are computed individually and merged into a single surface using first order least square fitting over the overlap areas.

This yields a series of slope function profiles or traces of the reflected wavefront in the direction of the long side of the mirror

- Finally, the slope profiles are numerically integrated in the same direction.

This yields a series of profiles or traces of the reflected wavefront in the direction of the long side of the mirror.

The computer outputs include:

1. A 3-D isometric plot representing a stack of the multiple traces of wavefront slope function
2. A 3-D isometric plot representing a stack of the corresponding multiple traces of the wavefront function.

In each case, a single trace of the wavefront slope or the wavefront itself can be extracted and displayed interactively by key in.

Along with the individual trace, the computation yields values for

- The root-mean-square (RMS) deviation
- The peak-to-valley (P-V) deviation.

In the following we show the computer plots (36 plots) for the wavefront slope and wavefront corresponding to a typical measurement.

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION

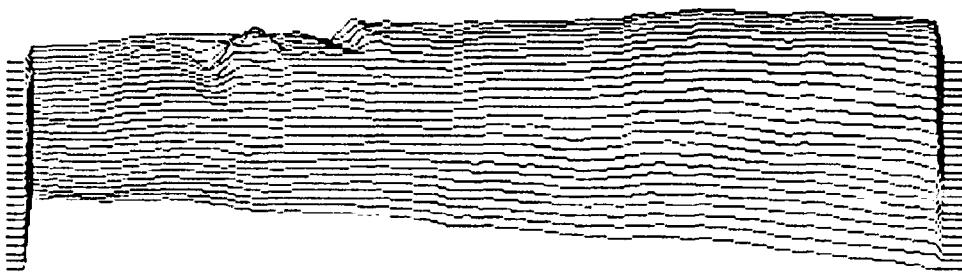


12 °/ LEVEL  
RMS 17.25986  
P-U 112.5427

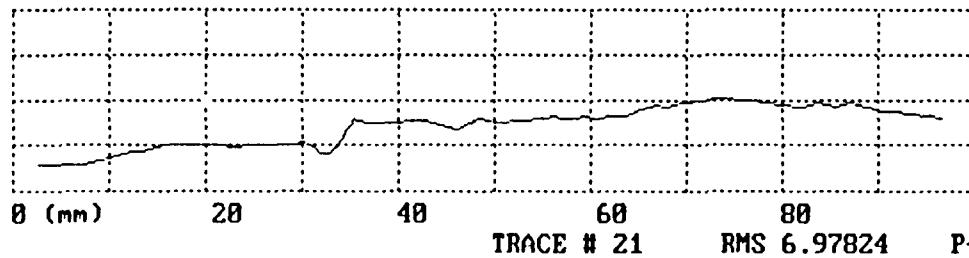
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Justification	
By <i>per ADA252253</i>	
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Availability Codes/	
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A-1	

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



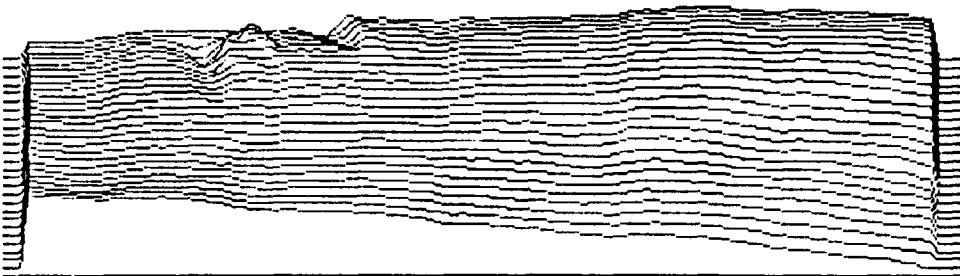
RMS 17.25986 P-V 112.5427



0 (mm) 20 40 60 80  
TRACE # 21

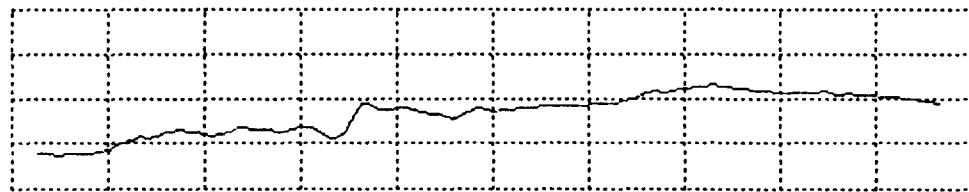
RMS 6.97824 P-V 52.4467

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



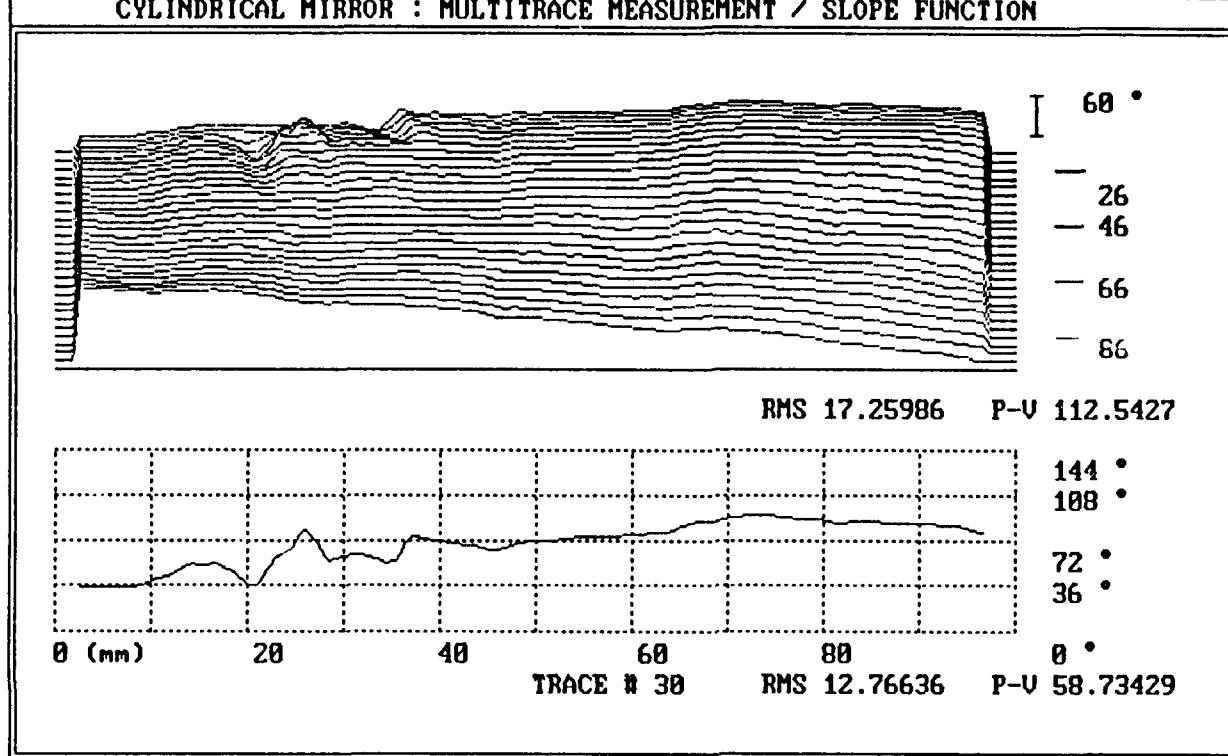
I  
60 °  
—  
26  
— 46  
—  
66  
—  
86

RMS 17.25986 P-V 112.5427

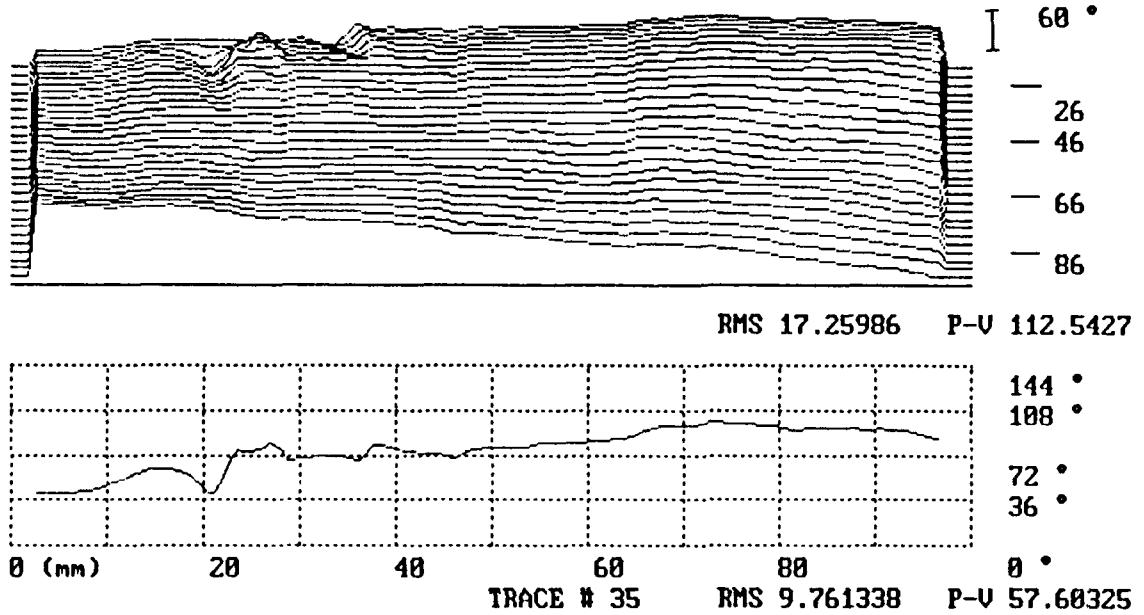


0 (mm) 20 40 60 80  
TRACE # 25 RMS 21.84303 P-V 55.91151  
144 °  
108 °  
72 °  
36 °  
0 °

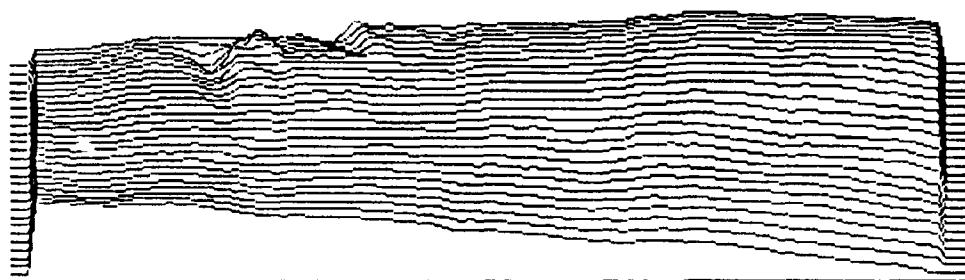
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION

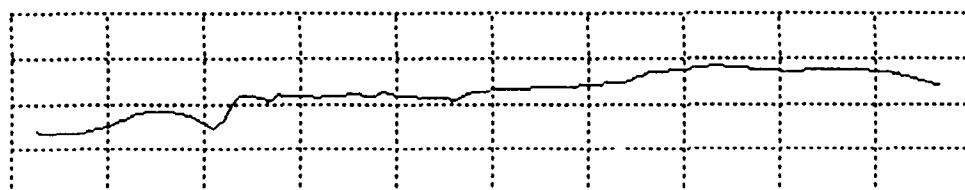


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



60 °  
— 26  
— 46  
— 66  
— 86

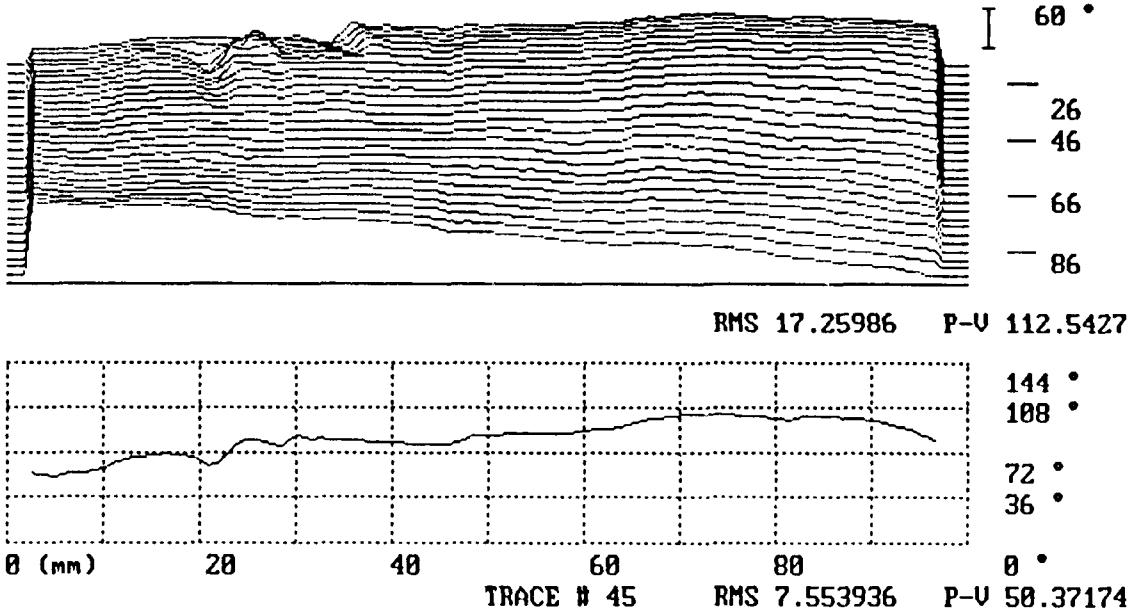
RMS 17.25986 P-V 112.5427



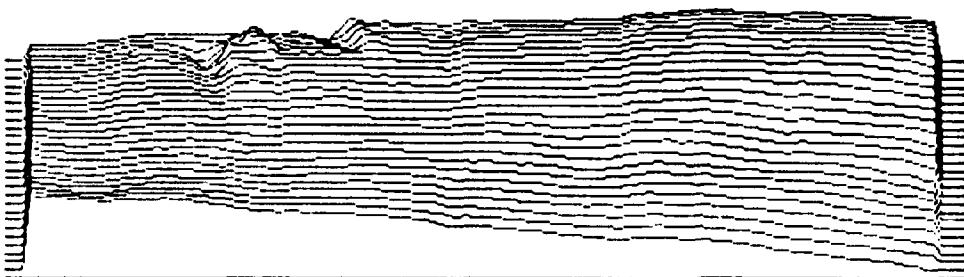
144 °  
108 °  
72 °  
36 °  
0 °

0 (mm) 20 40 60 80 TRACE # 40 RMS 8.547321 P-V 53.7146

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION

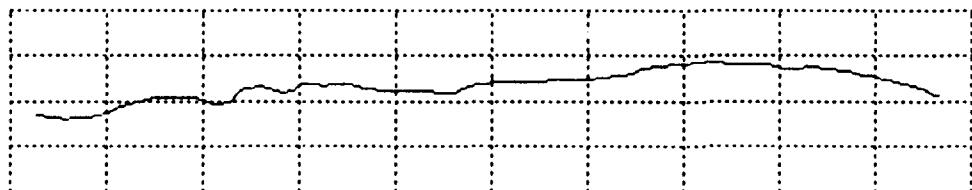


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



60 °  
—  
26  
—  
46  
—  
66  
—  
86

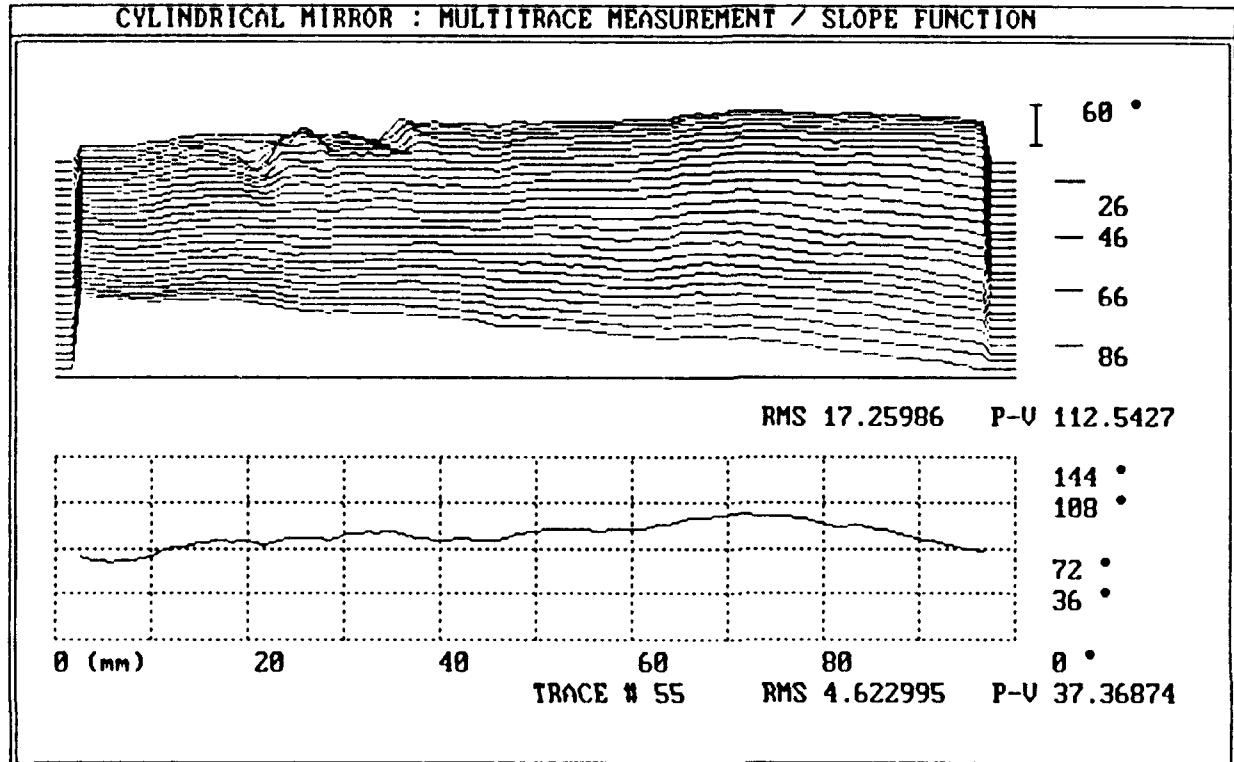
RMS 17.25986 P-U 112.5427



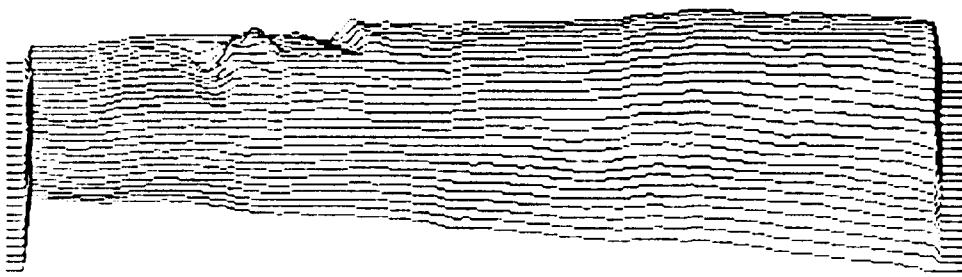
θ (mm) 20 40 60 80 RMS 6.345053 P-U 44.41621

144 °  
108 °  
72 °  
36 °  
0 °

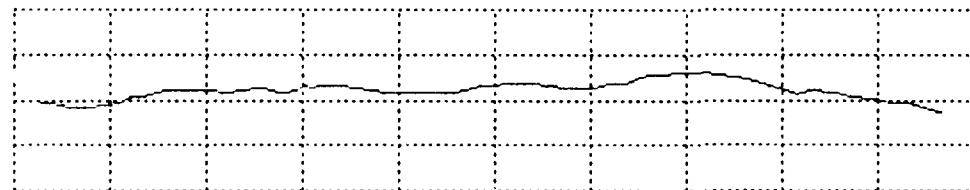
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



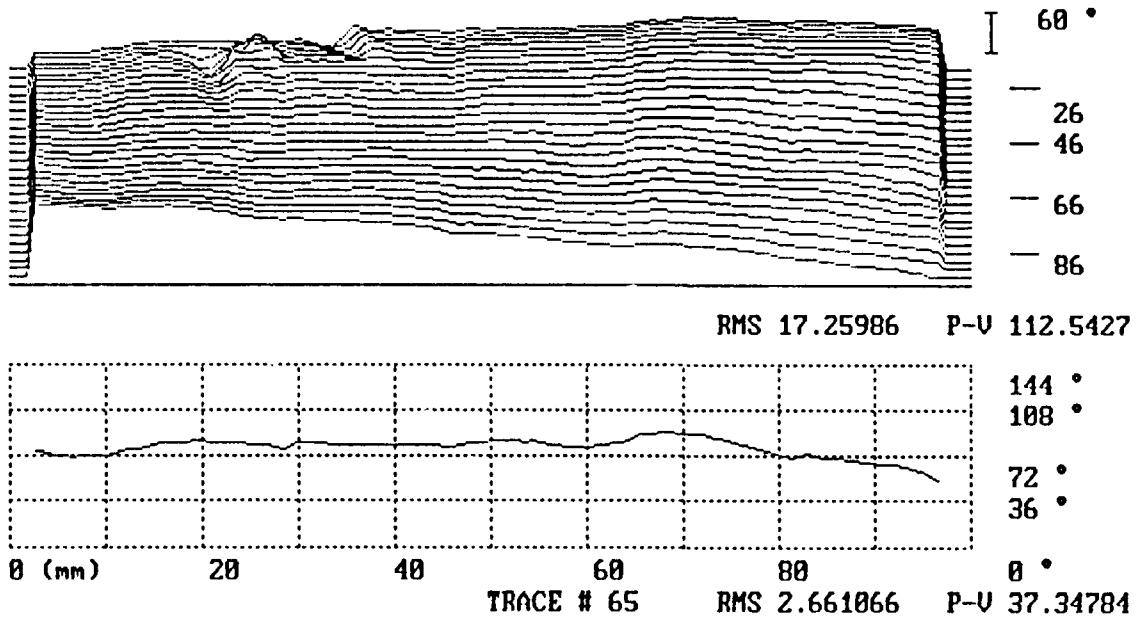
RMS 17.25986 P-U 112.5427



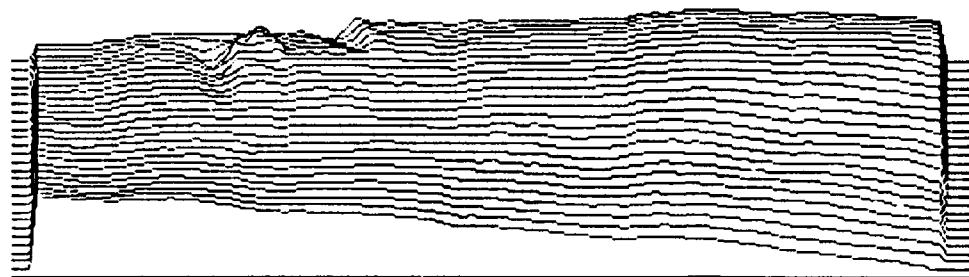
144 °  
108 °  
72 °  
36 °

0 °  
RMS 3.246115 P-U 31.79525

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION

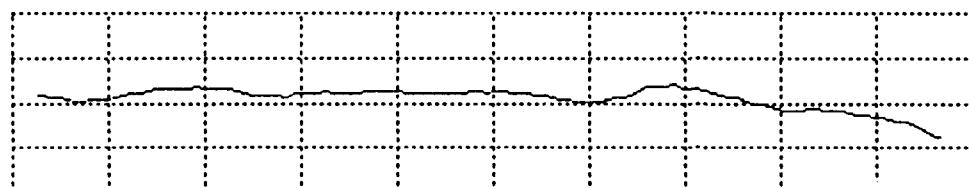


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



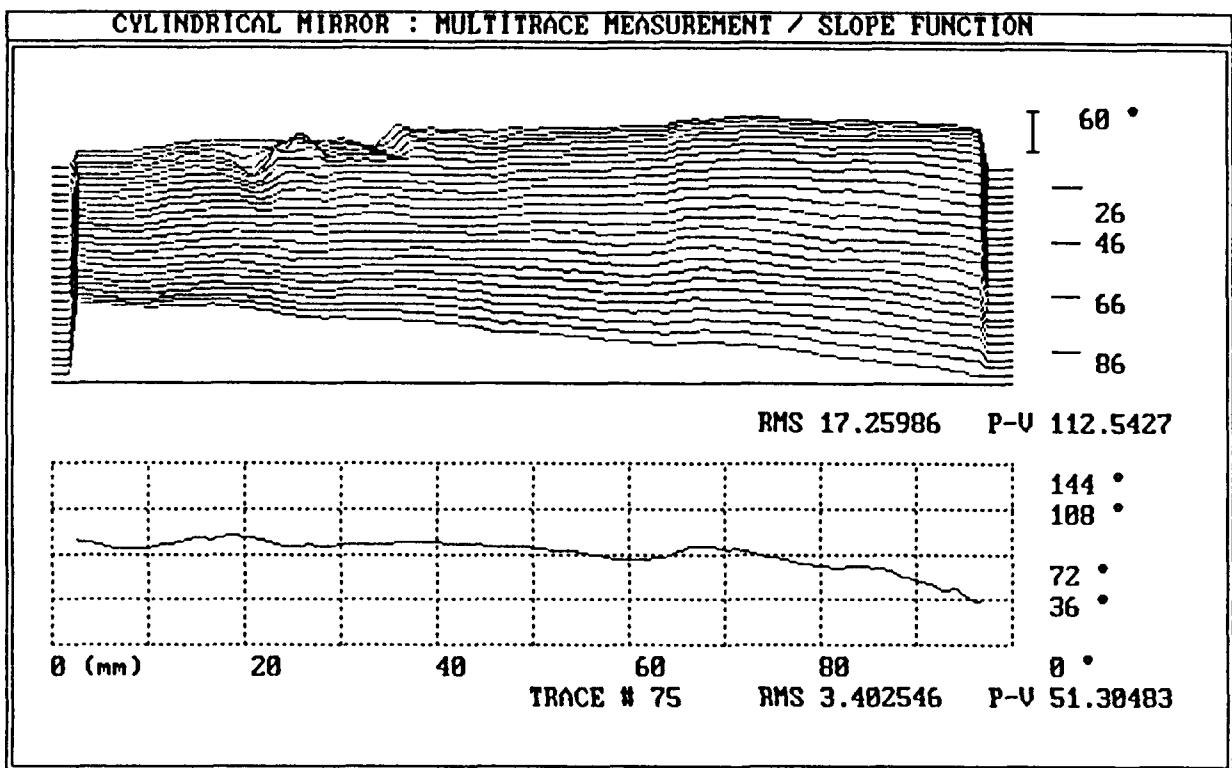
60 °  
—  
26  
— 46  
— 66  
— 86

RMS 17.25986 P-V 112.5427

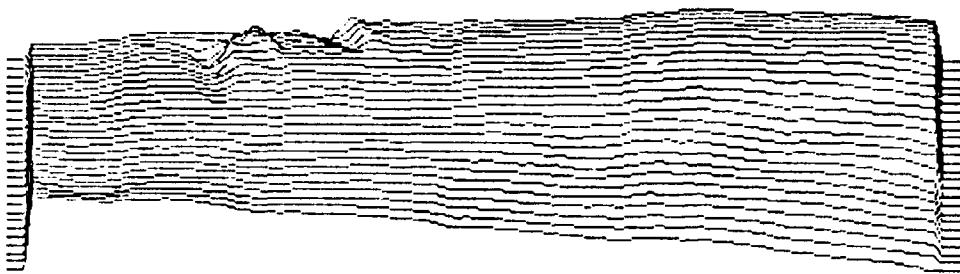


144 °  
108 °  
72 °  
36 °  
0 °

0 (mm) 20 40 60 80 TRACE # 70 RMS 2.678192 P-V 41.50981

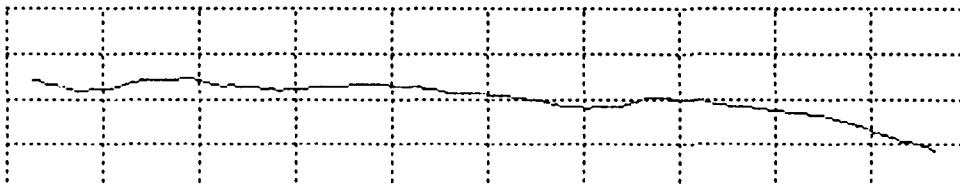


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



I  
60 °  
—  
26  
—  
46  
—  
66  
—  
86

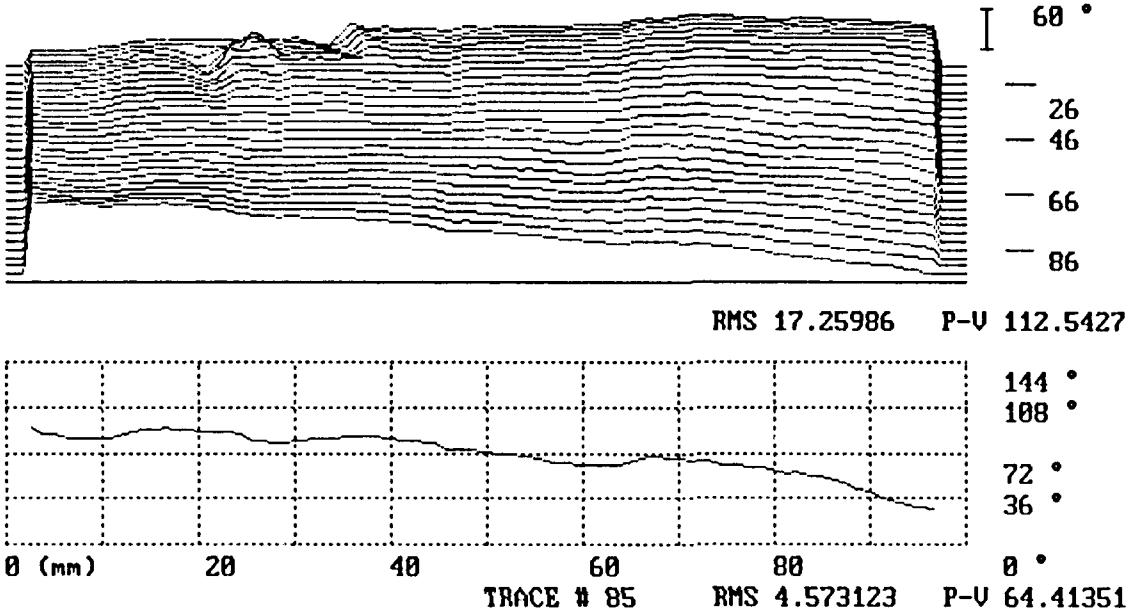
RMS 17.25986 P-U 112.5427



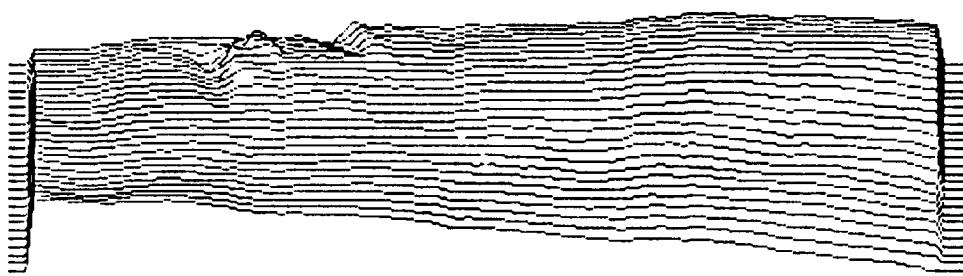
144 °  
108 °  
72 °  
36 °  
0 °

0 (mm) 20 40 60 80 RMS 3.83541 P-U 57.69175  
TRACE # 80

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION

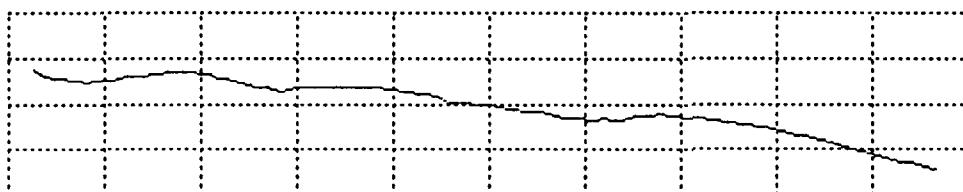


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



I  
60 °  
— 26  
— 46  
— 66  
— 86

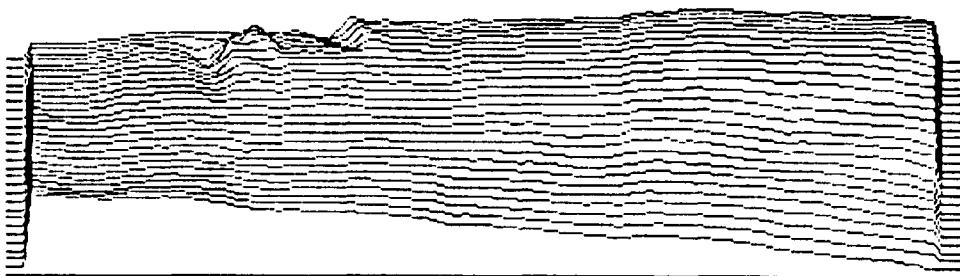
RMS 17.25986 P-V 112.5427



144 °  
108 °  
72 °  
36 °  
0 °

0 (mm) 20 40 60 80 RMS 5.676682 P-V 78.65374  
TRACE # 90

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



I  
68 °  
—  
26  
—  
46  
—  
66  
—  
86

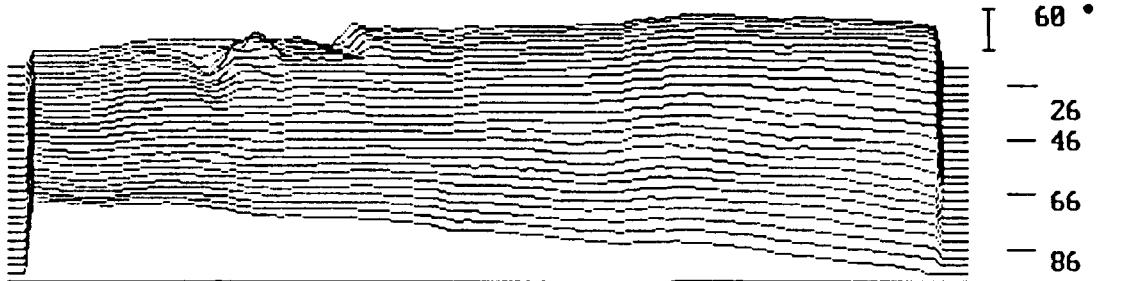
RMS 17.25986 P-U 112.5427



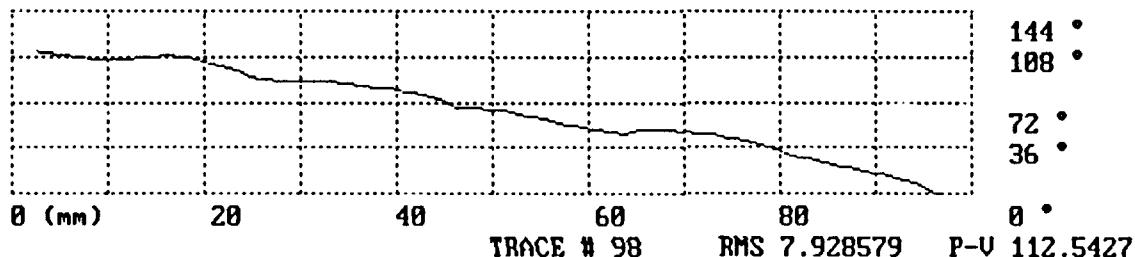
144 °  
108 °  
72 °  
36 °  
0 °

0 (mm) 20 40 60 80 TRACE # 95 RMS 7.191752 P-U 97.85846

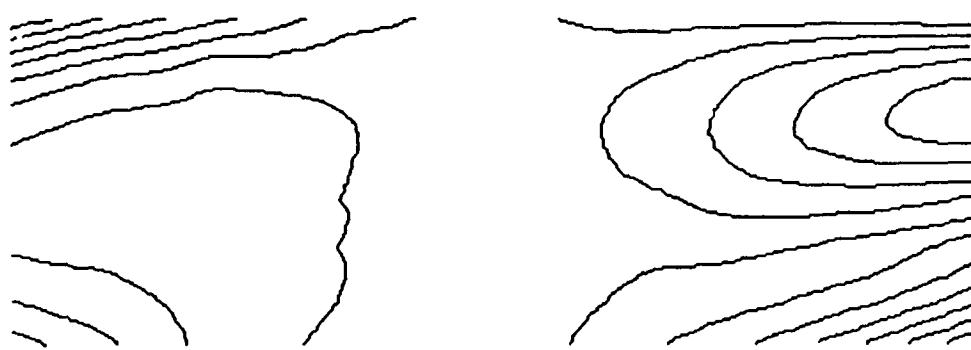
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / SLOPE FUNCTION



RMS 17.25986 P-U 112.5427

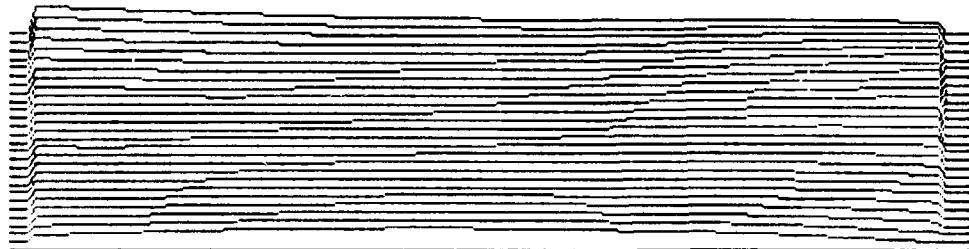


CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



180 °/ LEVEL  
RMS 275.4231  
P-V 2648.377

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 •

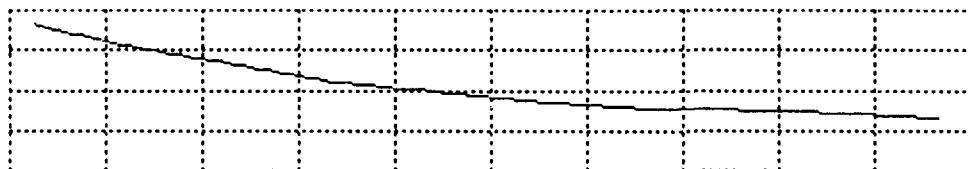
— 26

— 46

— 66

— 86

RMS 275.4231 P-V 2648.377



2880 •

2160 •

1440 •

720 •

0 •

0 (mm)

20

40

60

80

TRACE # 21

RMS 119.4098

P-V 1705.787

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION

I 1800 •

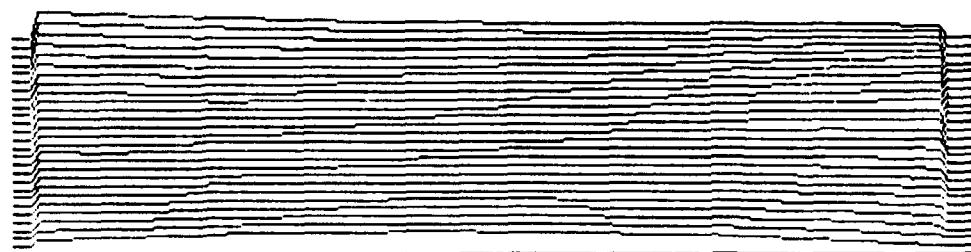
—  
26  
— 46  
— 66  
— 86

RMS 275.4231 P-V 2648.377

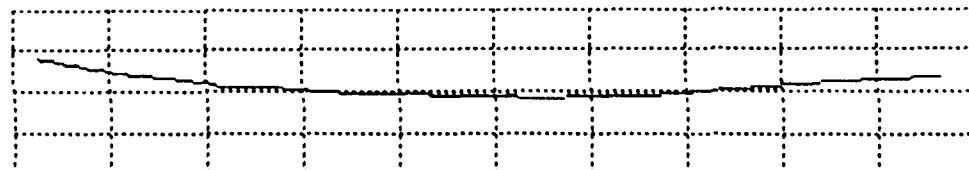
2880 •  
2160 •  
1440 •  
720 •  
0 •

0 (mm) 20 40 60 80  
TRACE # 25 RMS 81.00263 P-V 1118.521

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



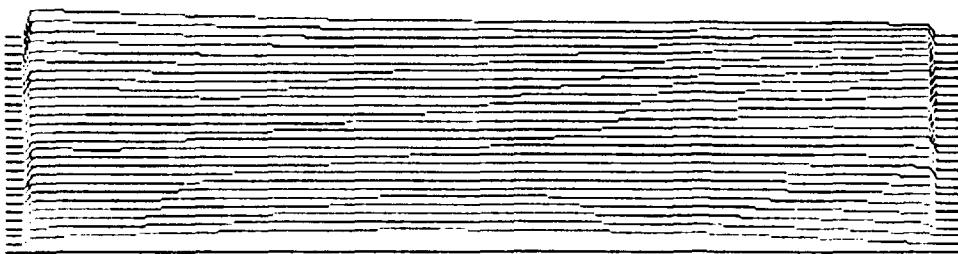
RMS 275.4231 P-V 2648.377



0 (mm) 20 40 60 80 RMS 54.41294 P-V 690.6887

TRACE # 30

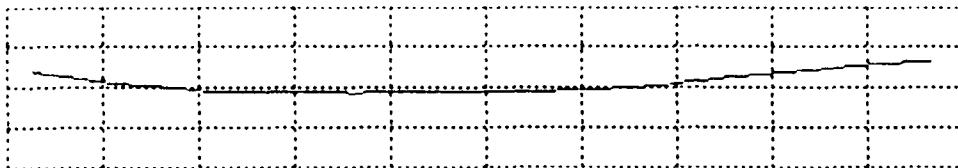
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

RMS 275.4231 P-U 2648.377



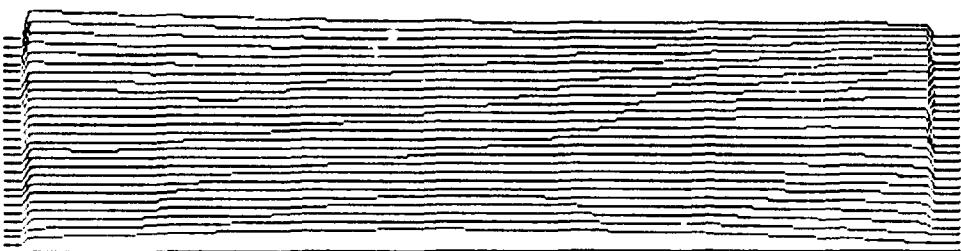
2880 °  
2160 °  
1440 °  
720 °

0 °

θ (mm) 20 40 60 80 RMS 53.24748 P-U 590.2791 TRACE # 35

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION

I 1200 °



RMS 275.4231 P-V 2648.377

2880 °  
2160 °  
1440 °  
720 °

0 °  
RMS 61.87016 P-V 816.8084

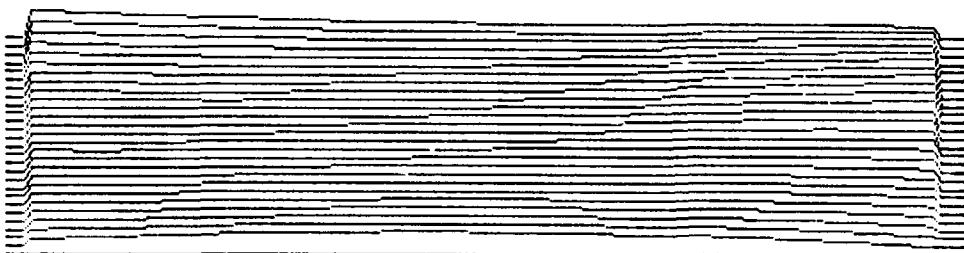
0 (mm) 20 40 60

TRACE # 40

80

26  
46  
66  
86

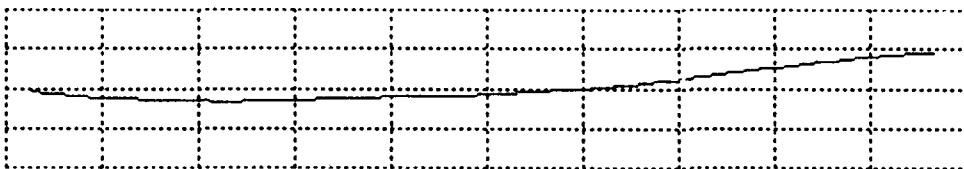
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

RMS 275.4231 P-U 2648.377



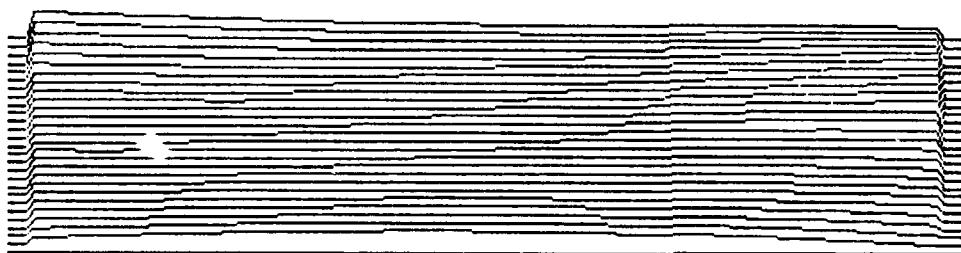
2880 °  
2160 °  
1440 °  
720 °  
0 °

0 (mm)      20      40      60      80

TRACE # 45

RMS 66.12693 P-U 906.5993

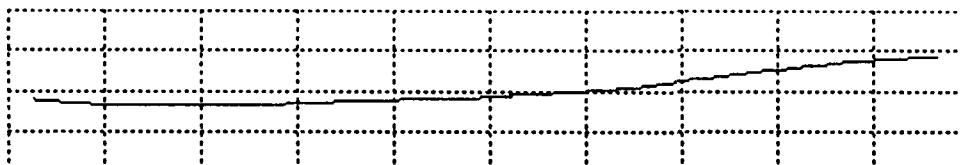
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

RMS 275.4231 P-V 2648.377



0 (mm)

20

40

60

80

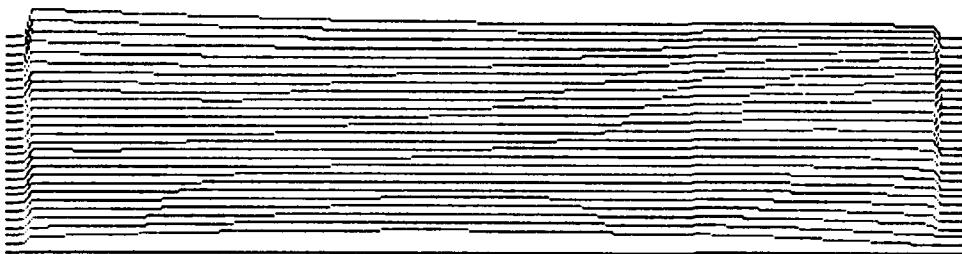
TRACE # 50

RMS 64.26296

P-V 873.4325

2880 °  
2160 °  
1440 °  
720 °  
0 °

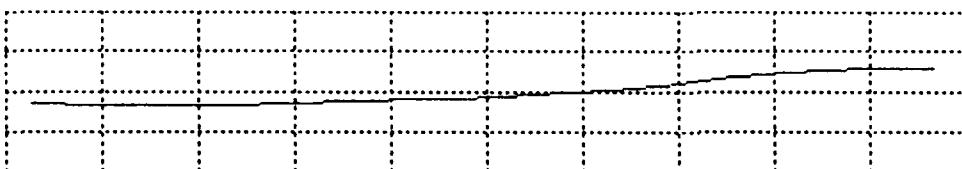
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

—  
26  
— 46  
— 66  
— 86

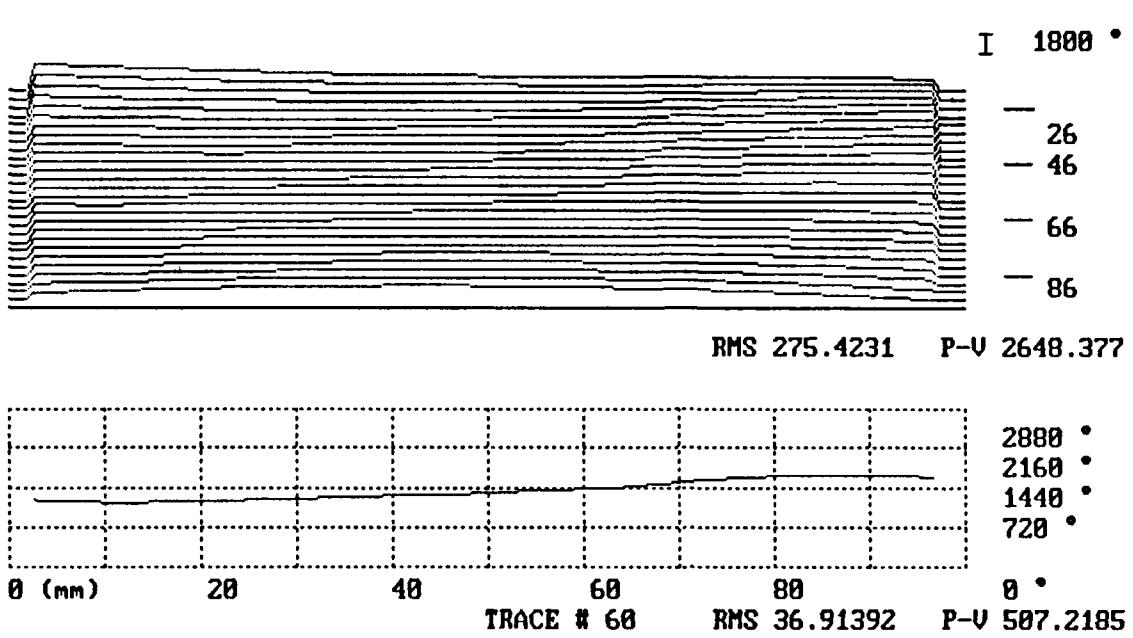
RMS 275.4231 P-U 2648.377



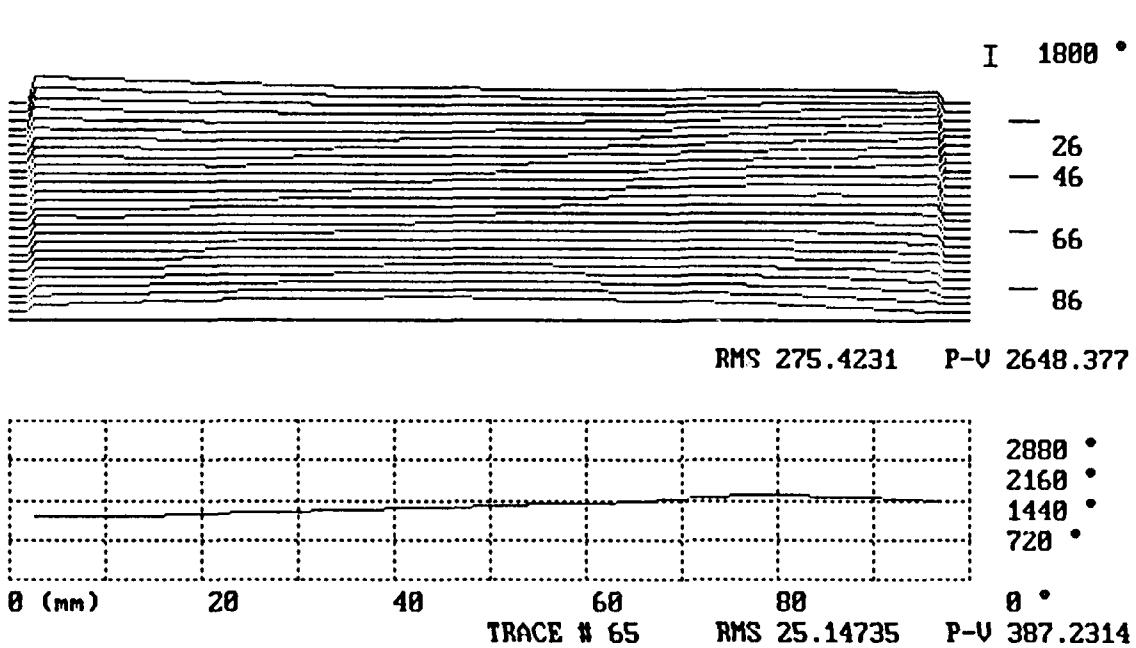
2880 °  
2160 °  
1440 °  
720 °  
0 °

0 (mm) 20 40 60 80 RMS 51.82453 P-U 688.2866  
TRACE # 55

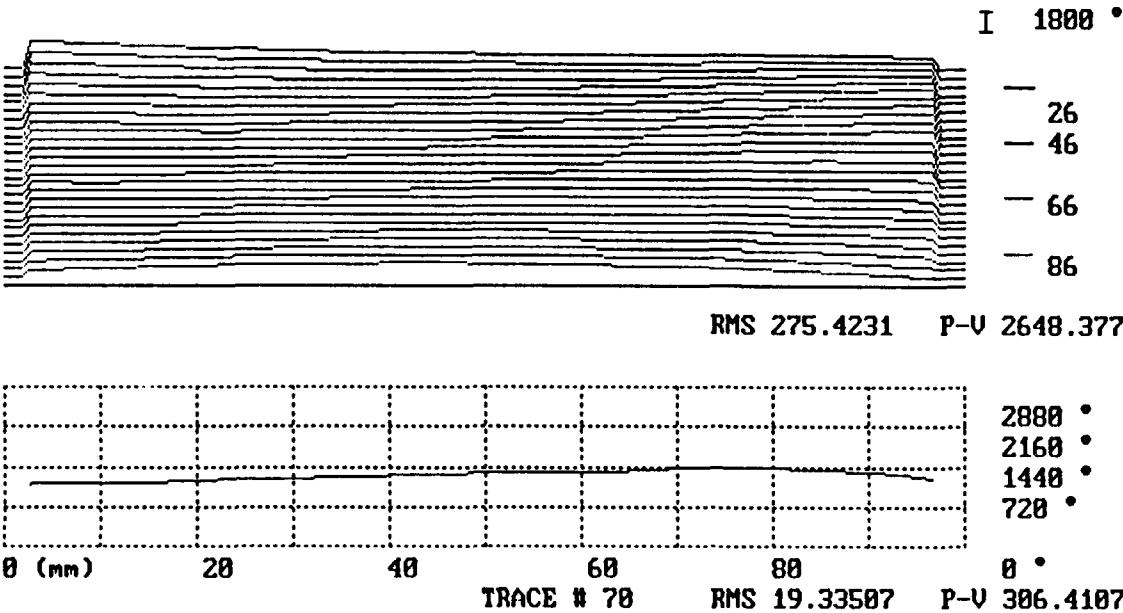
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



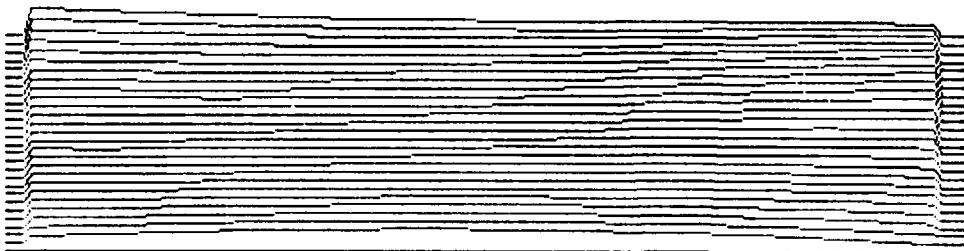
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



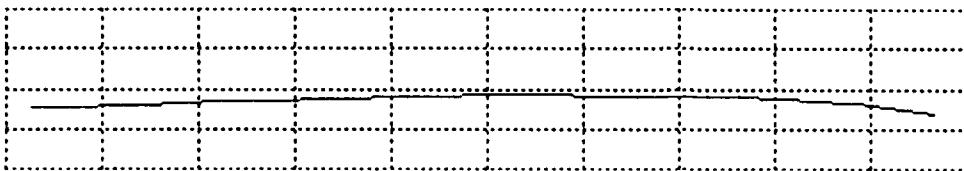
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

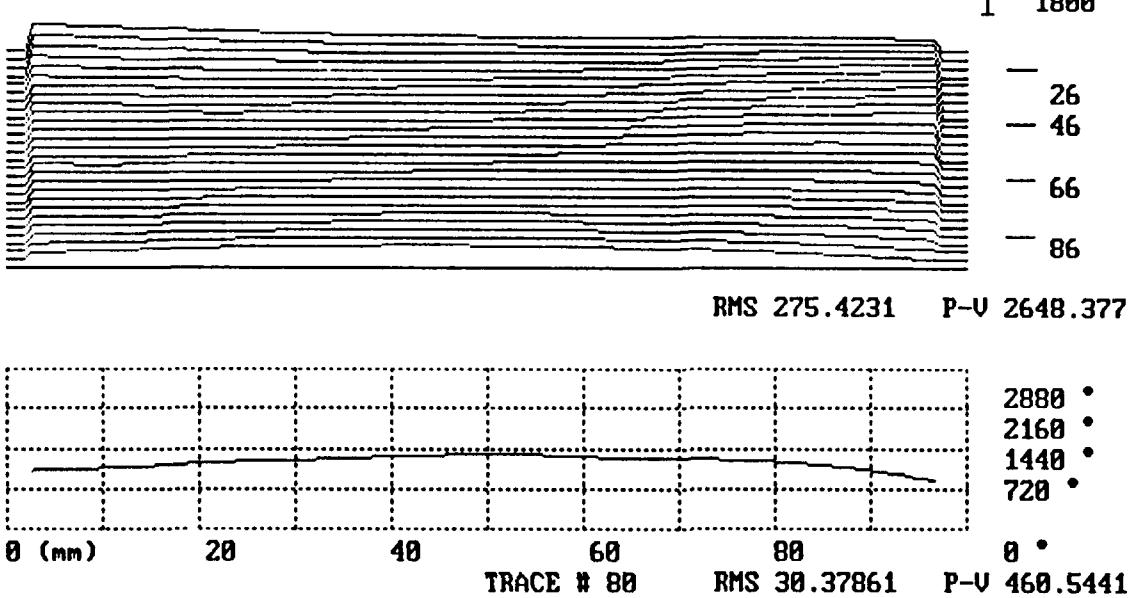
RMS 275.4231 P-V 2648.377



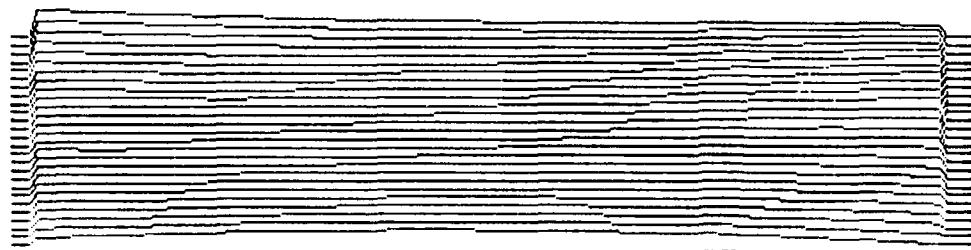
2880 °  
2160 °  
1440 °  
720 °  
0 °

θ (mm) 20 40 60 80 RMS 23.08077 P-V 349.8361

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



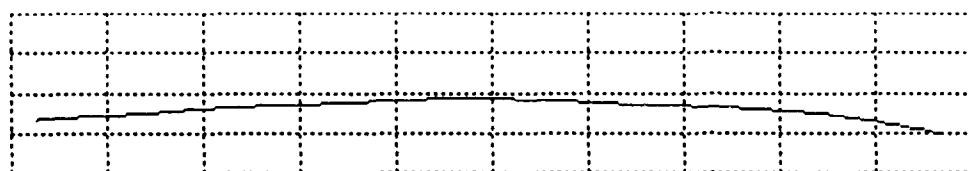
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

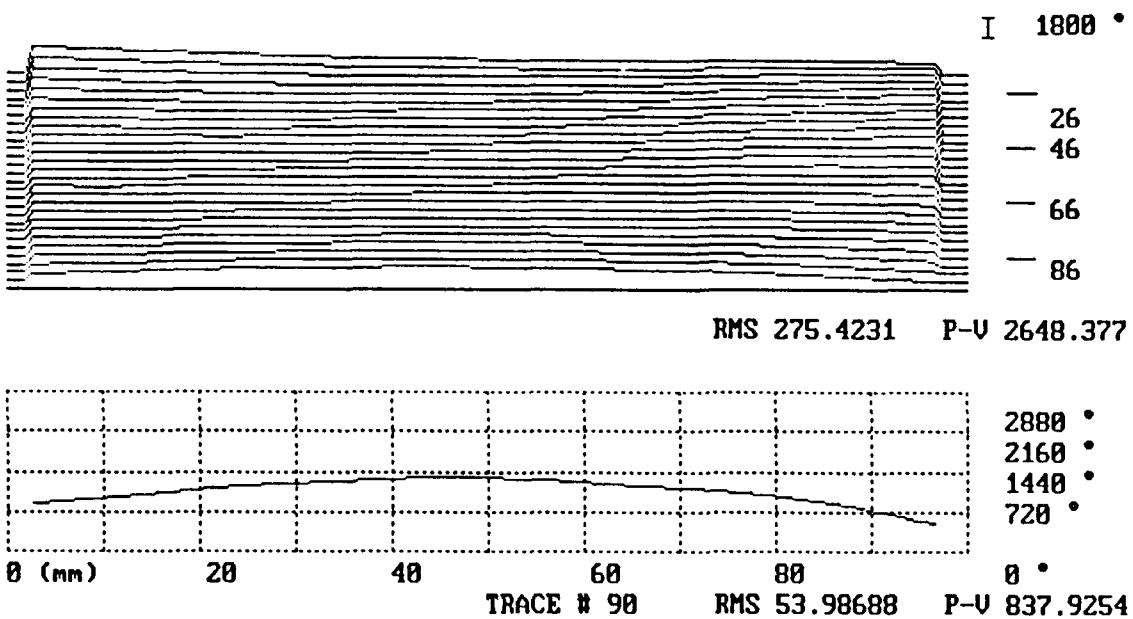
RMS 275.4231 P-V 2648.377



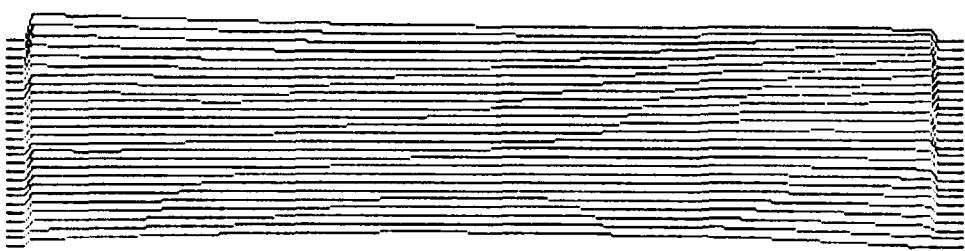
2880 °  
2160 °  
1440 °  
720 °

0 (mm) 20 40 60 80 0 °  
TRACE # 85 RMS 40.37565 P-V 616.2419

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



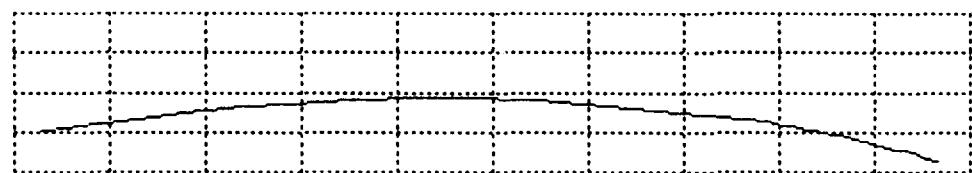
CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION



I 1800 °

— 26  
— 46  
— 66  
— 86

RMS 275.4231 P-U 2648.377



2880 °  
2160 °  
1440 °  
720 °  
0 °

TRACE # 95 RMS 71.74483 P-U 1138.347

CYLINDRICAL MIRROR : MULTITRACE MEASUREMENT / WAVEFRONT FUNCTION

